HISTORICAL PERSPECTIVE OF WHITE PINE IN THE CLEARWATER NATIONAL FOREST

White pine was a major component of the timber inventory in the early 1900's and was one of the primary reasons for the early logging boom. White pine was often found in relatively pure stands and records report volumes ranging as high as one million board feet per acre!*

From the early nineteen hundreds until the mid 1930's, white pine made up the bulk of the volume (estimated to be 35-50% of the standing volume).*

Blister rust in combination with logging and the mountain pine beetle have had a very large impact on the Clearwater forests.

White pine blister rust was introduced in 1910 on the west coast but the first mortality was not reported until about 1940. However, once mortality started, white pine forests were quickly liquidated in attempts to beat the disease and bark beetles. Timber Cut and Sold Reports show that 44,964 MBF of white pine sawtimber was harvested in 1968. In 1992 this figure dropped to 1,101 MBF.

Unfortunately, the natural regeneration was rapidly infected and killed, so there was very little natural replacement of the white pine stands. White pine was replaced primarily by grand fir and Douglas-fir which are highly susceptible to root disease and western spruce budworm. (see root disease and budworm info.)

As part of Region One's Ecosystem Management Project, John Losensky developed some gross estimates of historical vegetation in North Idaho using data from timber surveys conducted in the 1930's. He estimated that the white pine cover type (stands with 20% or greater white pine) accounted for 65% (380,000 acres) of all National Forest land in Clearwater County and 22% (70,000) acres of the National Forest land in Latah County. The white pine cover type accounted for 69% and 79% of the commercial timber acres of National Forest ownership in Clearwater County and Latah County, respectively.

White Pine Blister Rust Situation Today. In a recent database query for stands with a plurality of white pine, only 8 stands out of 331 were found (based on surveys that had been conducted in the early 1970's).*

More than one-third of these stands were in an age class of 0-40, while another 29% were in 41-80 yr age class.

Nearly one third of the 331 stands had some sort of stem rust reported on them. (Unfortunately, the level of rust intensity is not given and some of this could be gall rust on lodgepole or ponderosa pine).

Blister Rust Situation in the Future. The white pine tree improvement project is now producing genetically improved white pine seedlings which have a much better chance of surviving to merchantable size. This program is continuing to broaden the genetic base of the resistance mechanisms and we would anticipate that it should be possible to make white pine a significant component of future stands.

Stands containing natural white pine can be expected to suffer high mortality especially on the younger age classes in high hazard areas. However, pruning of the lower branches from white pine when they are quite young may also result in more white pine surviving. Therefore pruning in conjunction with precommercial thinning should be strongly considered in areas where white pine is desirable.

Although it may not be ecologically desirable to grow pure white pine stands, there is no reason that white pine cannot be a major component of a mixed forest in the future.

---

*someone on the Clearwater NF may have data that can improve upon this.

DWARF MISTLETOE ON THE CLEARWATER NATIONAL FOREST

Dwarf mistletoes are parasitic plants that extract water and nutrients from living host trees causing decreased height and diameter growth, reduction in seed and cone crops, and direct mortality or predisposition to other pathogens or insects. Dwarf mistletoes are native components of the forest ecosystems of their hosts, having co-evolved with their hosts for millions of years. There are 3 dwarf mistletoes of interest on the Clearwater National Forest: larch dwarf mistletoe (A. laricis), lodgepole pine dwarf mistletoe (A. americanum), and Douglas-fir dwarf mistletoe (A. douglasii).

Dwarf mistletoes only grow and reproduce on living trees, therefore, forces (either natural or human-caused) that have patterned the development of the host species have also played important roles influencing the patterns of dwarf mistletoes on the landscape. Large, complete burns or clear cuts would serve to reduce the incidence of dwarf mistletoe. The larger and more continuous the disturbance, the greater the reduction in dwarf mistletoe incidence at the landscape level. Small, "patchy" burns or cuts help perpetuate dwarf mistletoe on the landscape as infected residuals provide a ready seed source for the infection of the newly-developing regeneration.

Status of Dwarf Mistletoe on the Clearwater. The best estimates we have of dwarf mistletoe incidence and timber impacts on the Clearwater come from a survey done by Region One Forest Pest Management in 1981. Field data was taken from plots in a total of 10 sub-compartments on the Pierce, Kelly Creek (now the North Fork area), Lochsa, and Powell Ranger Districts. Results from the survey are shown in the following table:

D.M Species	Acres of Comm. Host Type *	% infested	Acres infested	Vol Loss (Ft^3/year)
Larch	16,300	55	8,965	179,300
Lodgepole	194,700	9	17,523	210,276
Doug-fir	286,600	.5	1,433	28,660

* -- Figures taken from Land Status Report. Type = >1/3 of host species.

The 1981 survey also found that the severity of disease incidence was quite high. The average dwarf mistletoe rating for infected trees was 5.1 for larch and 3.3 for lodgepole pine (on a scale from 1-6). Growth and yield impacts on a stand basis are greatest in stands with a pure component of the host species, especially those with a multi-storied structure.

Dwarf Mistletoe Utilization by Wildlife. Several bird species are reported to eat dwarf mistletoe seeds, and squirrels and porcupines preferentially eat the bark associated with dwarf mistletoe infections. Dwarf mistletoe shoots can be an important winter food source for many animals including porcupines,

squirrels, grouse, mule deer, and elk. The witches brooms produced as a result of dwarf mistletoe infection provide cover and nesting sites for small mammals and birds, including several owl species.

Historical Perspective of Dwarf Mistletoe on the Clearwater. We believe that the present distribution of dwarf mistletoe on the Clearwater is very similar to the historic condition and that this distribution is tied very closely to the different fire regimes of the forest. Under fire regimes characterized by large-scale, complete burns, dwarf mistletoe was kept at very low levels and it's spread was very limited. Dwarf mistletoe is prevalent today in areas where fires did not burn the host tree species as completely. The high **incidence** of infection in western larch is probably due to the fact that larch is so highly fire resistant. The low **incidence** of infection in the Douglas-fir may indicate that much of the Douglas-fir type on the Clearwater was subjected to large-scale, complete burning events. Douglas-fir dwarf mistletoe was perpetuated in areas characterized by small, patchy fire events and incomplete burns that promoted a mutli-storied canopy structure. The amount of infection in the lodgepole pine type indicates that much of this type did burn rather completely, but there were other areas that were subjected to the incomplete scenario. In areas where certain cutting practices have created multi-storied stand structures that historically would have been single-storied (particularly in the case of Douglas-fir), we can assume that the incidence of dwarf mistletoe has increased to levels above the historic "norm". We believe that the **severity** of dwarf mistletoe infection (as found in the 1981 survey) is probably higher than would have occurred in pre-settlement time because fire suppression has elimination the large scale fires which acted as periodic "cleansing events".

Dwarf Mistletoe and Land Management Planning. Traditionally, dwarf mistletoe management has emphasized the impacts on the timber resource, and the parasitic plant has been targeted as a pest that must be suppressed. However, dwarf mistletoes should be recognized as functional components of the forest ecosystems in which they occur. It should not be our goal to eradicate dwarf mistletoe from the landscape. Dwarf mistletoe reduction may be warranted in stands where management goals emphasize timber production. In areas where management is not focused on timber, however, dwarf mistletoe control may not be desirable.

BARK BEETLE AND DEFOLIATOR CONDITIONS ON THE CLEARWATER NF PAST AND PRESENT

BARK BEETLES

Douglas-fir Beetle

Current Conditions. Over the past 5 years, the Douglas-fir beetle has killed between 3,000 and 13,000 trees annually on the Clearwater National Forest (NF) on about 800-5,000 acres. The highest year in the past 5 was 1988 when 13,000 trees were killed.

Past Outbreaks. The most dramatic Douglas-fir beetle outbreak on the Clearwater NF was during 1971-74 when 15% (111 million board feet) of the merchantable Douglas-fir on the forest was killed. During the peak of that outbreak, 288,000 acres were infested. This outbreak was triggered by populations building in trees felled during construction for Dworshak Reservoir. Outbreaks of this magnitude are not expected to occur in the future unless another "artificial" trigger event occurs.

The worst recorded outbreak occuring under natural conditions was from 1950-52. During that outbreak, an estimated 34 million board feet were killed on the Clearwater NF. In 1952, 77,000 acres were infested. Extensive windthrow occurred during the winter of 1948 which probably contributed to the population increase.

Another outbreak was recorded in 1938. No quantitative data were taken but "severe losses occurred in the Douglas-fir". This outbreak followed a 10-year drought.

Forest Susceptibility. Douglas-fir beetle populations build in slash, blowdown, and trees weakened by defoliation and disease. When populations are high enough, they attack and kill apparently healthy trees. Outbreaks usually last from 2-4 years. Forest susceptibility to Douglas-fir beetle attack increases with increases in the proportion of Douglas-fir, stand density, and age. Most susceptible stands are those with a high proportion of old Douglas-fir (greater than 120 years), and stocked at a level of 80% or more of normal stocking for the site.

Future Conditions. Outbreaks of the Douglas-fir beetle will continue to occur over time as long as high hazard stand conditions exist. These outbreaks will be triggered by blowdown or drought conditions. Endemic populations may now be higher than that of the past as the amount of root diseased Douglas-fir has increased.

Mountain Pine Beetle

Current Conditions. Over the past 5 years, mountain pine beetle populations have been very low in the major host trees (ponderosa pine, lodgepole pine, and

western white pine). The largest populations currently are in western white pine where about 1,000 trees were killed in 1992.

Past Outbreaks. The most important outbreaks of the mountain pine beetle on the Clearwater NF occurred in mature western white pine. From 1934-1953, it was estimated that the mountain pine beetle killed at least half of the original mature white pine volume.

Forest Susceptibility. In lodgepole pine stands, those that are most susceptible have an average age of 80 years or more, an average diameter of 8 inches or larger, and are located at an elevation and latitude with climate favorable to the beetle.

Ponderosa pine stands that are most susceptible are single storied, have an average diameter of 10 inches or greater, and a basal area of 150 square feet or higher.

The mountain pine beetle can be chronic in mature western white pine. Trees over 90 years old and greater than 10 inches in diameter are susceptible. The largest and oldest trees in a stand are the most susceptible.

Future Conditions. The mountain pine beetle will continue to cause losses in pine stands as they grow into susceptibility. Mountain pine beetle populations in western white pine have been low since much of the mature white pine has been killed in the past by either blister rust or the beetle. As rust resistant and natural young western white pine stands grow into maturity, we will probably see more losses caused by the mountain pine beetle.

Other Bark Beetles

Populations of western pine beetle, pine engraver, and spruce beetle have been very low over the past 5 years on the Clearwater NF and have not caused great losses in recent history.

DEFOLIATORS

Douglas-fir Tussock Moth

Current Conditions. Populations are currently monitored with pheromone traps. Since 1987, trap catches have been way below the threshold of a building population.

Past Outbreaks. Outbreaks of the Douglas-fir tussock moth have occurred about every 9-11 years on the Clearwater NF and have been recorded there since 1944. Major outbreaks occurred during 1944-47, 1962-65, and 1973-74 with most of the damage occurring on the Palouse Ranger District and surrounding state and private land. Acreages defoliated varied from 115,000 to 395,000 in Latah, Benewah, and Clearwater counties. Large acreages of forested land were sprayed with DDT during each of these outbreaks in attempts to control the tussock moth population. Populations were increasing again on the Palouse RD in 1986 and high risk areas were to be sprayed with the nuclear polyhedrosis virus (NPV), a

biocontrol agent that causes a disease specific to tussock moths. The spray project was cancelled when tussock moth populations decreased due to natural causes.

Forest Susceptibility. Outbreaks of the tussock moth occur explosively, with populations building up rapidly, and usually last from 2-4 years. Defoliation reduces tree growth, kills tops, or completely kills trees. Defolitated trees are also susceptible to attack by bark beetles. During past outbreaks in heavily defoliated areas, 30-70% of trees from saplings to mature sawtimber have been killed. Forests that are most susceptible to damage by the tussock moth in northern Idaho are older, dense, multi-storied, and have a high proportion of grand fir. They are located on or near ridge tops, and on sites with poorer productivity and with little or no volcanic ash.

Future Conditions. Outbreaks of the Douglas-fir tussock moth will continue to occur periodically on the Clearwater NF, especially in areas of historic outbreaks. The extent and intensity will vary as the amount of susceptible forested areas varies and changes. Populations have been high over the past few years in eastern Oregon and southern Idaho. Populations in northern Idaho are expected to increase over the next several years.

Western Spruce Budworm

Current Conditions. No visible defoliation has been recorded from aerial surveys on the Clearwater NF over the past decade (Appendix 1).

Past Outbreaks. In the past 46 years there were two budworm outbreaks on the Clearwater National Forest: 1950-1959 and 1966-1975. During the intervening years, no budworm defoliation was reported from aerial surveys (Appendix 1).

The maximum budworm defoliation year was 1975 when 683,997 acres, 38% of the Clearwater's forested land base was affected. Of the 683,997 acres 24% was heavily defoliated; 23% was moderately defoliated; and 53% was lightly defoliated. During 1975, budworm defoliation extended from the northern forest boundary south to the wilderness boundary, and from the eastern boundary to 44 degrees longitude. During the 1970's, most of the damage was rated as heavy or extreme with 50 to 100% of the new growth defoliated. Little top kill and mortality was recorded on pole and sawlog size trees. Growth declined by approximately 25% on host trees.

Studies in a mixed conifer stand on the Clearwater NF that had been defoliated by budworm for 10 years showed that top kill occurred on 12.8% of trees in the stand, resulting in significant height growth loss. Grand fir and subalpine fir had the most top kill, with 12.3 and 21.2% of trees per acre top killed, respectively. In spruce, top kill occurred on 8.7% of trees per acre. No top kill was found in Douglas-fir.

Future Conditions/Hazard. The western spruce budworm routinely causes conspicuous damage to host trees in the northern Rocky Mountain States. Differential effects on host trees have been observed. True firs (grand fir and subalpine fir) display the most severe damage symptoms, whereas Douglas-fir and spruce are not damaged as severely in mixed host types.

Budworm hazard ratings have been assigned to all stands on the Clearwater that were examined with a type 12 survey in the 1970's. Budworm hazard ratings for stands surveyed ranged between 0 and 26.42. The budworm hazard rating is a scale of 1-100, 0 denotes nonsusceptibility and 100 optimal budworm habitat. For example, if a stand receives a hazard rating of 90, this would mean that stand conditions exist that would support a budworm outbreak. Although the highest hazard rating for stands examined on the Clearwater was only 26.42, hazard ratings are relative to areas compared. Therefore, hazard ratings on the Clearwater ranging between 20-26.42 would be considered to be high compared to hazard ratings between 0-5.

The relative hazard rating of stand susceptibility is based upon seven stand and site factors: composition, density, vigor, maturity, height structure, site climate, regional climate and surrounding forest. The most susceptible stands are composed of predominately true firs, are dense, of low vigor, older, uneven-aged, on warm, dry sites, and surrounded by similar forest type. The hazard ratings derived for this analysis were from stand data collected during the early 70s. Stand conditions have changed since that time and consequently so would the hazard ratings. Unless stands received treatment after 1973, hazard ratings have probably increased over the last 20 years as stands have continued to mature and more stands are composed of predominately true firs.

Average Hazard Rating by Subcompartment

511621	8.25
511681	9.11
511781	5.57
511991	9.60
53611	3.68
53782	0.31
53861	1.81
531382	5.40
532232	4.60
532371	2.90
532743	1.11
532752	1.09
532913	7.48
533422	6.03
533871	**0.00**
534322	3.16
534733	2.62
534994	0.05
55112	1.90
534112	4.57
551213	8.75
551332	**18.22**
552124	5.35
56277	15.10
561655	6.33
562022	8.68
562631	5.00
562891	3.70
563421	8.30
532743	3.1

Appendix 1
Budworm defoliation Detected by Aerial Survey on the Clearwater National Forest: 1948-1992

Year	Acres
1948	0
1949	0
1950	10,600
1951	23,700
1952	80,380
1953	80,400
1954	86,700
1955	101,910
1956	119,370
1957	126,045
1958	118,123
1959	103,964
1960	0
1961	0
1962	0
1963	0
1964	0
1965	0
1966	33,870
1967	127,250
1968	240,600
1969	294,140
1970	360,000
1971	378,000
1972	397,600
1973	414,680
1974	591,479
1975	634,830
1976	358,070
1977	286,407
1978	8,115
1979	0
1980	320
1981	175
1982	0
1983	0
1984	0
1985	0
1986	0
1987	0
1988	0
1989	0
1990	0
1991	0
1992	0